

# **Reciprocal vocalizations between female caregivers and their infants surpass those of male caregivers in the first months of life**

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**Women & Infants'**

# Background



- Hearing and language acquisition are processes that begin in utero<sup>1-3</sup>
  - The fetus can hear and respond to sound and is capable of auditory memory and learning
- Exposure in utero to maternal speech is important for language development
  - Infants have a natural preference for their mother's speech and language<sup>4</sup>

<sup>1</sup>Gerhardt & Abrams, *J Perinatol* 2000    <sup>2</sup>Abrams & Gerhardt, *J Perinatol* 2000    <sup>3</sup>Mayberry et al., *Nature* 2002

<sup>4</sup>Moon & Fifer, *J Perinatol* 2000

# Background



- Verbal interactions between mother and infant have positive effects on language development<sup>1,2</sup>
  - Infant vocalization is influenced by maternal verbal behavior and is important in language development as it mimics adult conversational exchanges<sup>3,4</sup>
- The father-infant language relationship has not been well studied in the first months of life

<sup>1</sup>Zimmerman et al., *Pediatrics* 2009

<sup>2</sup>McCathren et al., *J Speech Lang Hear Res* 1999

<sup>3</sup>Jasnow & Feldstein, *Child Dev* 1986

<sup>4</sup>Goldstein et al., *Child Dev* 2009

# Research Objectives



- Evaluate an infant's language environment in the first months of life
- Compare differences between the verbal interactions of mothers and fathers with their infant
- Assess an infant's vocal response to adult male and female speech

# Hypotheses



- Infants will be exposed to more adult female than adult male speech in the first months of life
- Female caregivers (mothers) will have more infant-directed speech than male caregivers (fathers); and, in turn, infants will vocalize more with their mothers

# Methods



- **Study design:**

- Prospective cohort study of medically stable late preterm (34-36 weeks gestation) and term infants

- **Study population:**

- 25 late preterm infants from the NICU
- 25 late preterm infants from the newborn nursery
- 25 term infants from the newborn nursery

- **Exclusion criteria:**

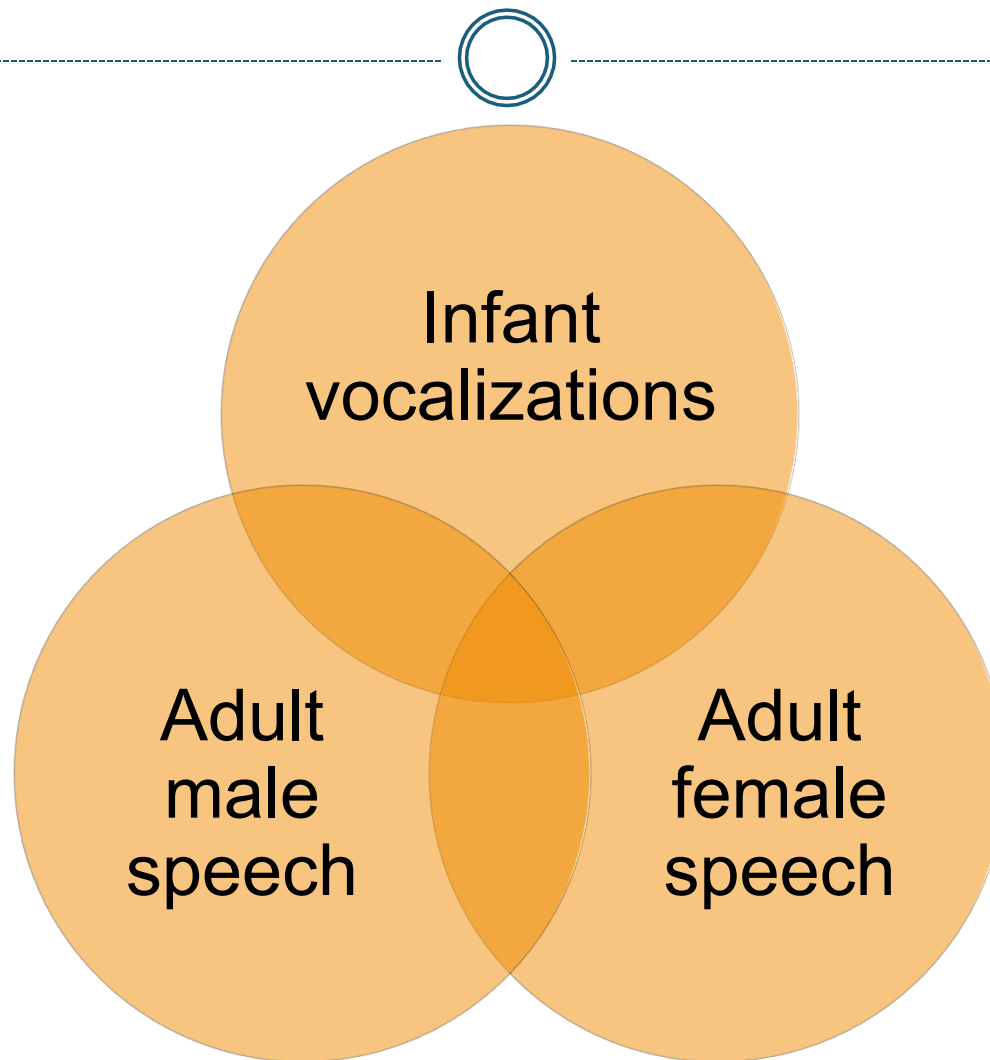
- Congenital anomalies, significant comorbidities, or identified hearing impairment

# Methods



- IRB approval
- Informed consent obtained
- Late preterm and term infants enrolled
- 16 hour audio recordings using the LENA™ system to measure adult word count, infant vocalizations, and conversational turns
  - Birth hospitalization
  - Home environment at 44 weeks corrected age

# Language Interactions





# Vocalization activity blocks



- Segments of the audio recording containing human vocalizations separated by  $\geq 5$ -second segments of silence
- Labeled by the initiator of and responder within each block
  - Infant initiated with adult female response
  - Infant initiated with adult male response
  - Adult female initiated with infant response
  - Adult male initiated with infant response

# Statistical Analysis



- Negative binomial and Poisson regression models were used to compare differences between adult male and female language interactions with their infant

# Results



- 70 newborn recordings were analyzed
  - 23 LPNICU, 25 LPNBN, and 22 Term infants
  - 5 excluded for irregularities including incomplete recording and early discharge
- 46 44-week corrected age recordings were analyzed to date
  - 14 LPNICU, 14 LPNBN, and 18 Term infants

# Results: Infant Characteristics



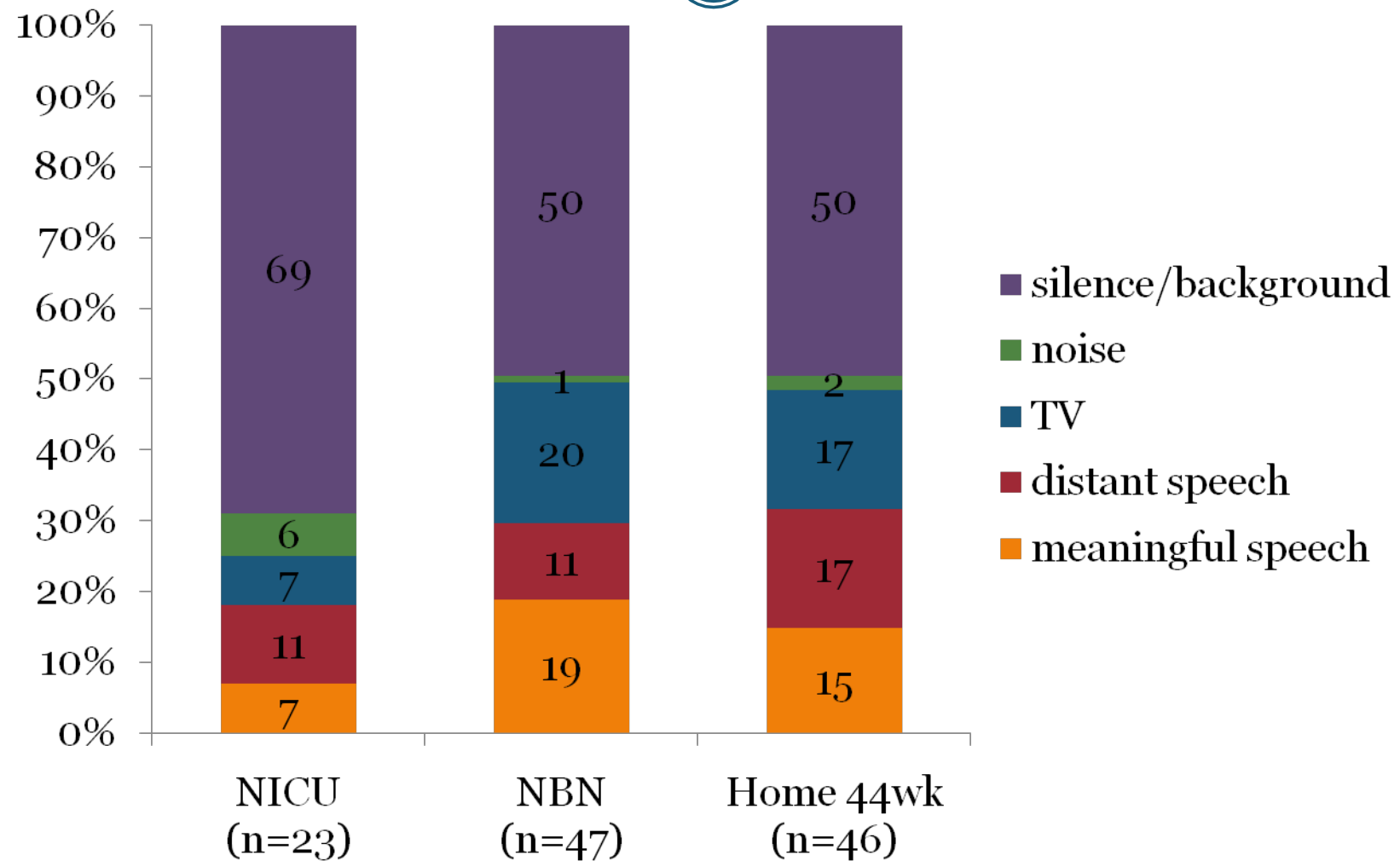
Infant Characteristic	LP NICU n=23	LPNBN n=25	Term n=22	p
Gestational age (wk): mean	34.6	35.9	39.5	<b>&lt;.0001</b>
Male gender: n (%)	12 (52)	13 (52)	11 (50)	0.99
Race/Ethnicity: n(%)				
White non-Hispanic	14 (61)	11 (44)	13 (59)	0.66
Black non-Hispanic	1 (4)	2 (8)	2 (9)	
Hispanic	5 (22)	4 (16)	1 (5)	
Asian	0	1 (4)	1 (5)	
Multiracial	3 (13)	7 (28)	5 (22)	
Public insurance: n(%)	12 (52)	13 (52)	10 (45)	0.35

# Results: Maternal characteristics



Characteristic	LP NICU n= 23	LPNBN n= 25	Term n= 22	p
Age (years): mean $\pm$ SD	28 $\pm$ 6	28 $\pm$ 6	29 $\pm$ 5	0.61
Race/Ethnicity: n(%)				
White non-Hispanic	14 (61)	15 (60)	15 (68)	0.90
Black non-Hispanic	1 (4)	2 (8)	2 (9)	
Hispanic	5 (22)	5 (20)	2 (9)	
Asian	1 (4)	2 (8)	1 (5)	
American Indian	1 (4)	0	0	
Multiracial	1 (4)	1 (4)	2 (9)	
Primiparous: n(%)	11 (48)	8 (32)	9 (41)	0.53
Maternal education: n(%) (> high school degree)	17 (77)	15 (68)	16 (84)	0.48

# Audio Environment



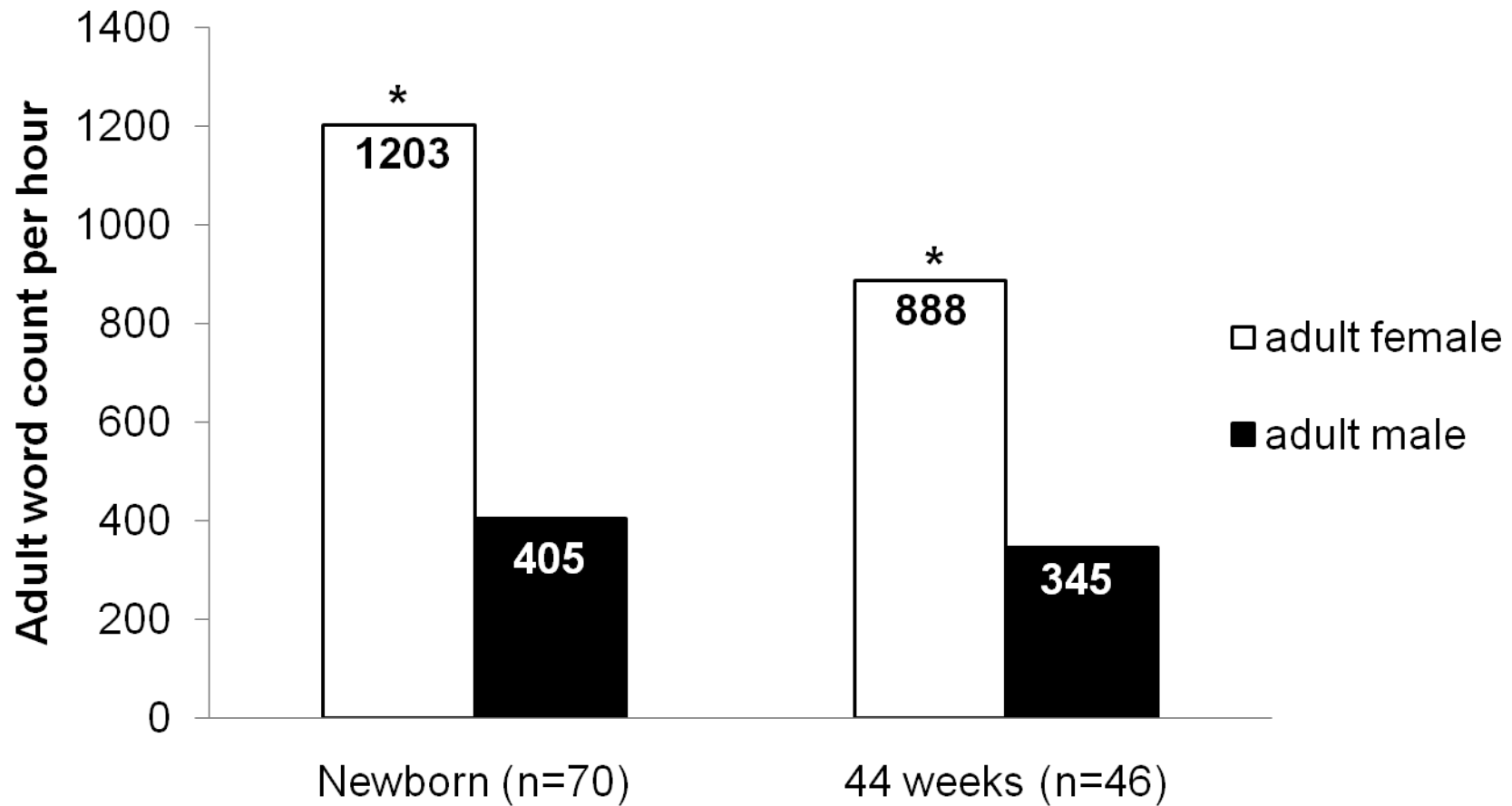
# Home environment at 44 weeks corrected age



	Single parent household	Two parent household
LP NICU (n=14)	2 (14%)	12 (86%) *
LP NBN (n=14)	1 (7%)	13 (93%)
Term (n=18)	1 (6%)	17 (94%)

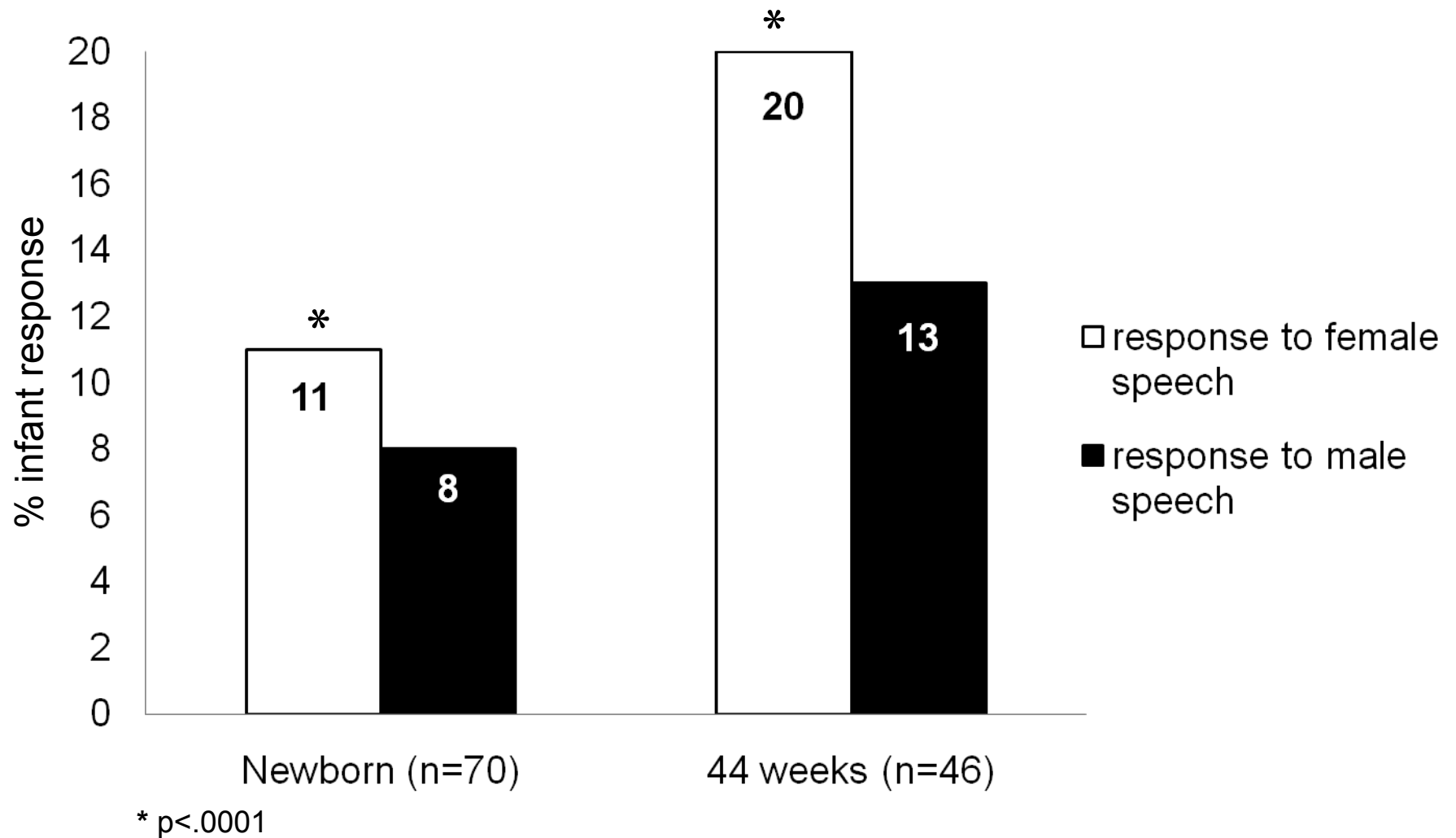
\*1 mom-mom household

# Adult word count by gender

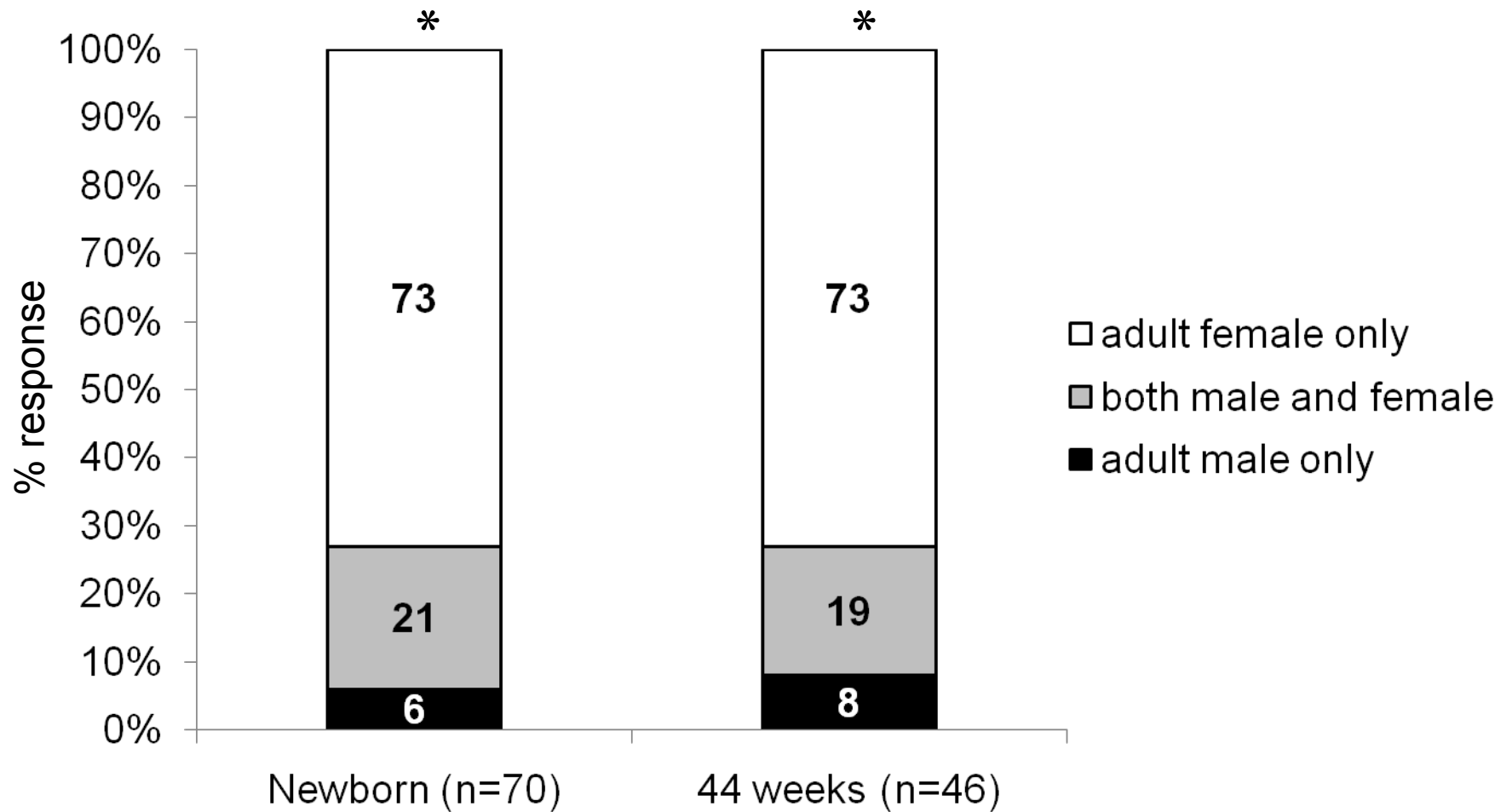




# Infant response to adult male and female initiated language blocks



# Adult male and female response to infant-initiated language blocks



# Parent vs. Nursing Staff Interaction

Vocalization patterns during feeding hours

NICU recordings (n=24)	Parent Feeding	Nurse Feeding	p value
# feeds	60	63	0.9
Mean adult word count /hr	1694	621	<.0001
Mean infant vocalizations/hr	34	25	0.15
Mean conversational turns/hr	13	6	< .01

# Parent vs. Nursing Staff Interaction

Mean number of language blocks per hour

NICU recordings (n=24)	Parent Feeding	Nurse Feeding	p value
# feeds	60	63	0.9
Adult response to infant	2.8	1.4	<.01
Infant response to adult female	6	2.2	<.01
Infant response to adult male	0.6	0.1	<.01

# Conclusions



- Infants are exposed to more adult female speech than male speech in the first months of life
- Language interactions including reciprocal vocalizations between female caregivers and their infants surpass those of male caregivers in the newborn period and 44 weeks corrected age

# THANK YOU

